

What is claimed is:

- 5 1. An additive composition, comprising:  
a Mannich reaction product of
  - a) a polyisobutylene alkylated hydroxyaromatic compound;
  - b) an aldehyde; and
  - c) an amine containing at least one reactive amino group, wherein the said
- 10 polyisobutylene is derived from a conventional polyisobutylene and a high vinylidene polyisobutylene.
2. The additive composition of claim 1 wherein the conventional polyisobutylene has a trisubstituted double bond isomer content of 45 mole % or greater.
- 15 3. The additive composition of claim 1 wherein the high vinylidene polyisobutylene has a combined alpha- and beta-vinylidene double bond isomer content of 70 mole % or greater.
- 20 4. The additive composition of claim 1 wherein the polyisobutylene of the alkylated hydroxyaromatic compound has an alpha- and beta-vinylidene double bond isomer content of 50 to 95 mole % and a trisubstituted double bond isomer content of 4 to 40 mole %.
- 25 5. The additive composition of claim 1 wherein the said polyisobutylene is derived by combining the conventional polyisobutylene and the high vinylidene polyisobutylene prior to the alkylation of the hydroxyaromatic compound.
- 30 6. The additive composition of claim 1 wherein the said polyisobutylene is derived by combining a hydroxyaromatic compound alkylated with the conventional polyisobutylene and a hydroxyaromatic compound alkylated with the high vinylidene polyisobutylene.

7. The additive composition of claim 1 wherein the said polyisobutylene is derived by combining a Mannich reaction product from a hydroxyaromatic compound alkylated with the conventional polyisobutylene and a Mannich reaction product from a hydroxyaromatic compound alkylated with the high vinylidene polyisobutylene.
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8. The additive composition of claim 1 wherein the said polyisobutylene has a number average molecular weight ranging from 500 to 3,000.
9. The additive composition of claim 1 wherein the hydroxyaromatic compound is phenol, the aldehyde is formaldehyde or a reactive equivalent thereof, and the amine is a secondary monoamine, an alkylenediamine, or a mixture thereof.
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10. A fuel additive concentrate composition for an internal combustion engine, comprising:
- 15 a solvent;  
the additive composition of claim 1; and  
optionally one or more additional fuel additives.
11. A fuel composition for an internal combustion engine, comprising:
- 20 a major amount of a fuel; and  
a minor amount of the additive composition of claim 1.
12. A fuel composition for an internal combustion engine, comprising:
- 25 a major amount of a fuel; and  
a minor amount of the fuel additive concentrate composition of claim 10.
13. A method to reduce deposit formation in a fuel system of an internal combustion engine, comprising:  
operating the engine with the fuel composition of claim 11.
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14. The polyisobutylene alkylated hydroxyaromatic compound of claim 5 as a functional additive and as an intermediate to a functional additive.

15. A process to prepare the polyisobutylene alkylated hydroxyaromatic compound of claim 14, comprising:
- a) forming a mixture of the conventional polyisobutylene and the high vinylidene polyisobutylene, and
- 5 b) reacting the mixture of conventional and high vinylidene polyisobutylenes with the hydroxyaromatic compound at 5 to 40°C in the presence of an acidic alkylation catalyst .
16. The process of claim 15 wherein the reaction of step b) is run at 20 to 40°C.